SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-47

Name: Pactola Reservoir **County:** Pennington

Legal description: Sec. 2-5, 10-11, T1N, R5E; and Sec.31-34, T2N, R5E
Location from nearest town: 0.5 miles east of Silver City, S.D.
Dates of present survey: June 2-4 and July 14-17, 2014
Date last surveyed: June 5-7 and July 15-18, 2013
Most recent lake management plan: F21-R-37 **Date:** 2005
Management classification: Coldwater Permanent

Primary Management Species:
1. Rainbow trout
2. Lake trout
3. Brown trout
4.
5.
6.
7.
8.
9.
10.
11.

Secondary and other species:
1. White sucker
2. Northern pike
3. Rock bass
4. Yellow perch
5. Largemouth bass
6. Rainbow smelt
7. Bluegill
8. Golden shiner
9. Green sunfish
10. Black crappie
11. European rudd

PHYSICAL CHARACTERISTICS

Surface Area: 785.3 acres **Watershed:** 204,154 acres
Maximum depth: 165.8 feet **Mean depth:** 62.3 feet
Lake elevation at survey: 4,580 ft (99% full)

Ownership of lake and adjacent lakeshore property

The Bureau of Reclamation (BOR) operates Pactola Dam and Reservoir in accordance with the needs dictated by downstream water demands such as irrigation, domestic water supply, regulation of Pactola Reservoir levels, and maintenance of minimum flows in Rapid Creek below the reservoir. The United States Forest Service (USFS) has jurisdiction over campgrounds, picnic areas, boat launches, access areas, and shoreline use. Private enterprises lease control of camping, marinas, and concession operations at various sites around the reservoir.

Fishing Access

A USFS visitor center, three parking lots, and some overlook areas are located on the dam. Veteran's Point, a handicap parking lot with fishing access piers, is located at the north end of the dam. Boat ramps, parking, and slip docks are located on the north and south ends of the lake. Shore fishing is common along the south shore where there are parking areas, trails, and a floating dock. Jenny Gulch Road provides access to the northwest end of the lake and is a popular area for shore and ice fishing.

Land Use

Silver City, Rochford, and several small developments exist in the upper Rapid Creek watershed above Pactola Reservoir but a majority of the watershed is public timber and grassland administered by the USFS. Substantial areas of private ownership do exist and much of the land immediately adjacent to the Rapid Creek watershed streams is privately owned with a small portion under tillage. Livestock grazing is widespread on both private and public lands. Much of the public land is under management for production of salable timber products. Extensive thinning of ponderosa pine on public land has taken place or is under way. Mountain slopes vary from moderate to extreme steepness on the lake shore as well as on the watershed. Roads and localized disturbances contribute to increased siltation.

Observations of Water Quality and Aquatic Vegetation

Emergent vegetation is light and grows primarily at the Rapid Creek inlet and in the shallow ends of bays off the main body of the lake. Sediment entering Pactola Reservoir from Rapid Creek seems to be the only apparent pollution concern in the reservoir.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, roads, etc)

All structures appear to be in good condition. In 1985-1986 the crest of the dam was widened and raised 15 feet. The rock-cut spillway was widened 150 feet to increase safety and capacity in the event of a major flood. At this time the splash pool below the spillway was also revamped. A low water boat ramp was installed at the north marina in 2005-2006.

MANAGEMENT OBJECTIVES

Objective 1. Maintain Pactola Reservoir as a put and take rainbow trout fishery through regular stockings of catchable (11 in) fish, where catch rates exceed 0.5 per hour.

Objective 2. To maintain a unique trophy lake trout population within the reservoir through special regulations (1 daily, 24 in minimum length) and large (15 in) fish stockings when needed.

Objective 3. To provide and maintain a brown trout population within the reservoir with stockings of catchable (11 in) fish when needed.

BIOLOGICAL DATA

Sampling Effort and Catch

A gill netting survey was conducted on July 14-17, 2014. Sampling consisted of 12 gill net nights (Table 1, Figure 1). Depths and GPS location were recorded to facilitate similar placement each year. A modified fyke (trap) net survey consisting of eight net nights was completed on June 2-4, 2014. Thirteen species of fish were collected from Pactola Reservoir in 2014 (Tables 2 and 3). Bluegill and yellow perch were the most abundant fish sampled in gill nets. Bluegill and rock bass were the most abundant in trap nets.

Table 1. Gill net dates, location, and depths set in Pactola Reservoir during the 2014 survey.

Set Date	Net #	UTM Lat	UTM Long	Depth (ft)
6/3	Trap 1	4882007	617356	Shore
6/2	Trap 2	4881847	615915	Shore
6/3	Trap 3	4880303	620667	Shore
6/2	Trap 4	4881757	616582	Shore
6/2	Trap 5	4881987	617784	Shore
6/3	Trap 6	4881308	619344	Shore
6/3	Trap 7	4880446	619926	Shore
6/3	Trap 8	4881899	620627	Shore
7/14	Gill 1	4880824	620497	30-50
7/14	Gill 2	4880424	621271	85
7/14	Gill 3	4880503	620396	12-36
7/15	Gill 4	4881708	620670	30-60
7/15	Gill 5	4880821	621123	30-60
7/14	Gill 6	4880610	621299	90-110
7/15	Gill 7	4881280	620116	50-80
7/16	Gill 8	4881319	619297	20-40
7/16	Gill 9	4881390	618958	80
7/16	Gill 10	4882097	618118	60
7/15	Gill 11	4881773	619509	90-100
7/16	Gill 12	4881772	618259	50

Table 2. Total catch of twelve 150-foot gill nets set in Pactola Reservoir on July 14-17, 2014. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	*Wr*-S (90%)
Bluegill	72	6.0 (6.8)	6.0 (6.8)	78 (8)	0	94.0 (1.9)
Brown trout	2	0.17 (0.15)	0.17 (0.15)	0	0	81.1 (22.7)
Lake trout	41	3.4 (1.4)	3.1 (1.2)	32 (14)	8 (8)	87.1 (2.4)
Northern pike	6	0.5 (0.5)	0.5 (0.5)	100	33 (43)	116.1 (13.0)
Rainbow smelt	6	0.5 (0.5)	0.5 (0.5)	-	-	-
Rainbow trout	21	1.7 (1.1)	1.4 (1.0)	0	0	132.1 (2.0)
Rock bass	17	1.4 (1.1)	1.3 (1.1)	33 (22)	0	95.1 (4.4)
White sucker	4	0.3 (0.3)	0.3 (0.3)	100	100	111.4 (16.8)
Yellow perch	59	4.9 (6.3)	4.6 (5.9)	13 (8)	0	94.4 (4.6)

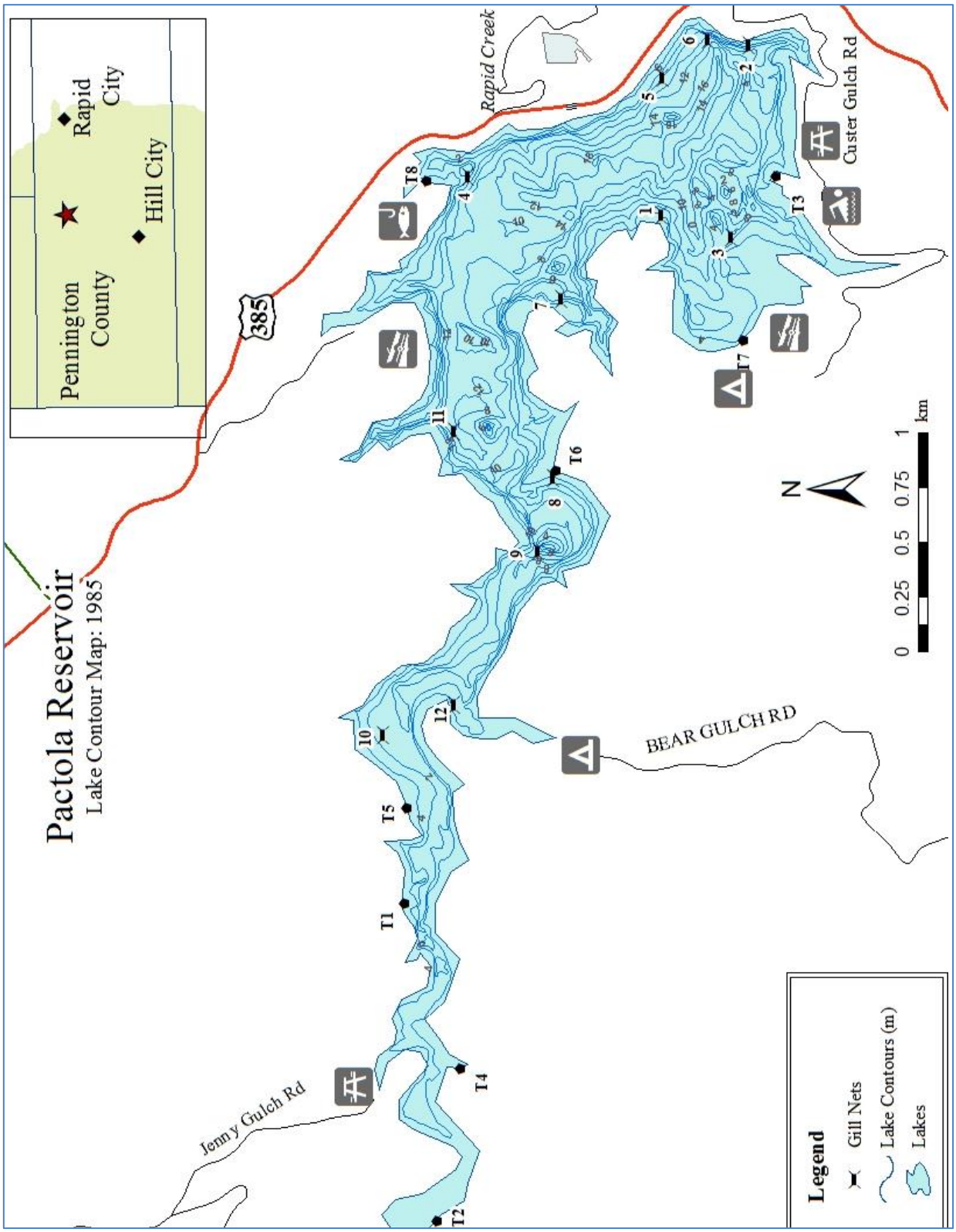

Figure 1. Location of survey nets set on Pactola Reservoir June 2-4 and July 14-17, 2014

Table 3. Total catch of eight trap nets set in Pactola Reservoir on June 5-7, 2014. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	*Wr*-S (90%)
Black crappie	17	2.1 (2.5)	2.1 (2.5)	53 (22)	0	90.1 (2.1)
Bluegill	166	20.8 (7.8)	20.6 (7.7)	58 (7)	10 (4)	88.0 (2.1)
Green sunfish	7	0.9 (0.7)	0.9 (0.7)	43 (39)	0	94.6 (13.6)
Largemouth bass	2	0.3 (0.2)	0	0	0	NA
Northern pike	1	0.13 (0.2)	0.13 (0.2)	100	100	118.8
Rainbow trout	3	0.38 (0.5)	0.13 (0.2)	0	0	-
Rock bass	264	33.0 (16.2)	31.6 (16.0)	51 (5)	13 (3)	95.1 (3.3)
European rudd	23	2.9 (4.0)	2.9 (4.0)	-	-	-
White sucker	1	0.1 (0.2)	0.1 (0.2)	100	100	86.8
Yellow perch	7	0.9 (0.6)	0.8 (0.6)	57 (39)	0	101.4 (14.5)

Rainbow trout

Pactola Reservoir is managed as a put-and-take fishery and receives over 30,000 rainbow trout stocked throughout the year. Gill net catch, however, is not normally high for rainbow trout and has been at some of the lowest values since 2006. Evaluating catch is complicated due to a few possible influencing factors, one being increased reservoir volume (Figure 2). Another is a change in scheduling (now done over a month after stocking) to avoid unnecessarily removing stocked fish. A third possible factor for the decrease is the establishment of a population of northern pike, an illegally introduced species first observed in 2003. A recent graduate study (Scheible 2013) found a dietary shift in prey importance as size of pike increased and rainbow trout made up over 60% of the energy input in pike greater than 600 mm. Future management options will be focused on these results and potential solutions are to increase stockings of catchable-size trout, only stock during high angling months when rainbow trout are targeted, or consider a different strain or size of rainbow trout.

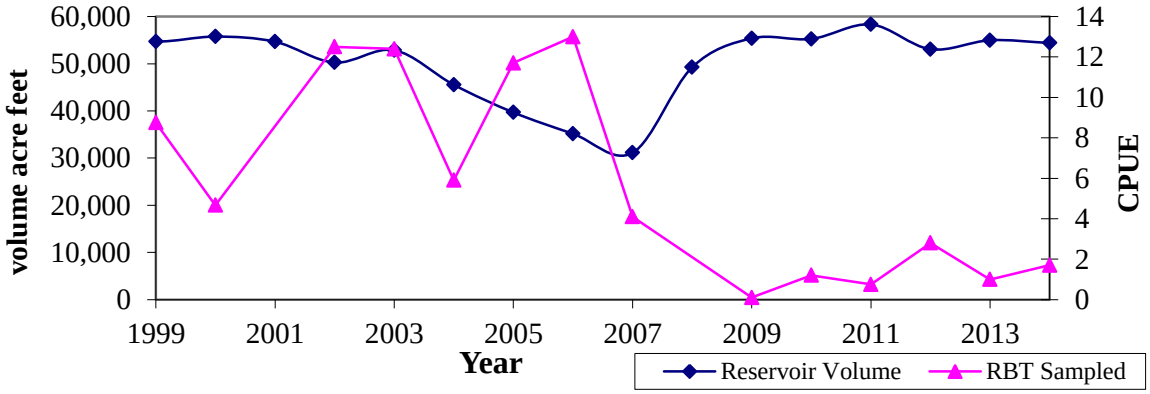

Figure 2. Pactola Reservoir July 31st volume (Bureau of Reclamation) and abundance of Rainbow trout sampled with gill nets, 1999-2014.

Brown Trout

Numbers of brown trout captured in gill nets has generally decreased since 2002, with only two surveyed during 2014 (Figure 3). Brown trout are not annually stocked into Pactola Reservoir, but approximately 3,000 and 8,000 brown trout were stocked in 2000 and 2002, respectively. Furthermore, 4,700 catchable brown trout were stocked in 2007 and likely explains the slightly higher catch prior to 2009. Brown trout relative abundance (CPUE) was lower in 2009-2014 than any of the past 14 years. Similar to rainbow trout catch, these results may be confounded by a number of influences such as: the increased volume of water in Pactola Reservoir, which reached 99.9% full in the spring of 2009 (Bureau of Reclamation), no supplemental stockings of hatchery brown trout in over 7 years, or the recently established northern pike population.

With only two individuals sampled, analysis cannot be extrapolated to the population. That being said, mean condition (*Wr*) of brown trout in Pactola Reservoir has remained in the 70s and low 80s (Figure 3, Table 4). Good condition values (*Wr*) for brown trout should be in the 90s. The 2011 and 2012 surveys yielded some of the largest brown trout ever recorded during a survey of Pactola Reservoir with lengths of 695 mm (27 in) and 640 mm (25 in), respectively. No individuals over 350 mm have come up in the annual survey since then, although one measuring 544 mm (21.4 in) was captured durring a concurrent survey using new North American standard gill nets.

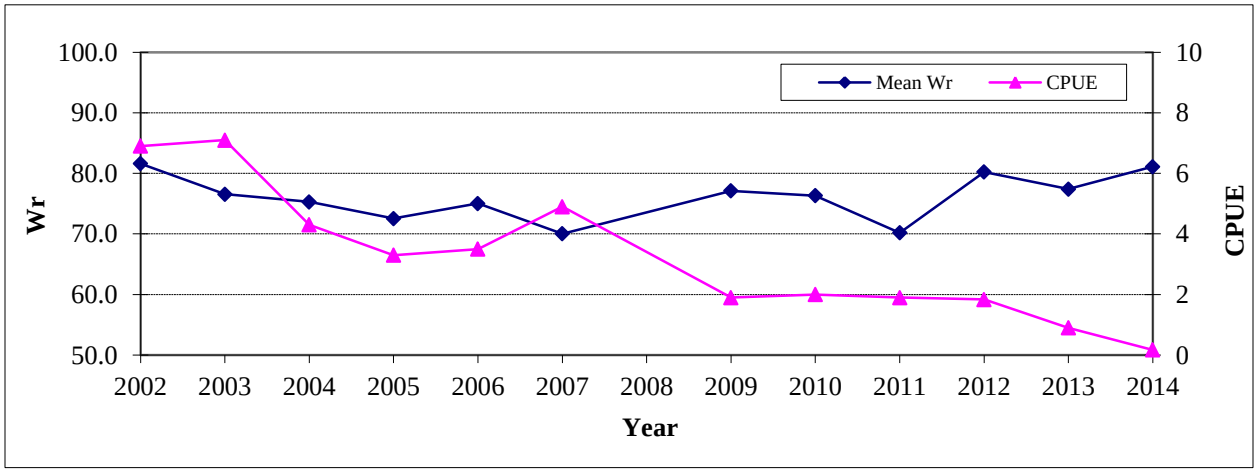

Figure 3. Trends in mean relative weight (*Wr*) and catch per unit effort (CPUE) for brown trout sampled with gill nets from Pactola Reservoir, 2002-2014.

Table 4. Catch per unit effort (CPUE), and mean relative weight (*Wr)* values for brown trout collected during gill net surveys in Pactola Reservoir, South Dakota, 2002-2007 and 2009-2014. Confidence intervals are presented in parenthesis.

Year	N	CPUE (80%)	Mean *Wr* (90%)	*Wr* < 355 mm (90%)	*Wr* > 355 mm (90%)
2002	97	6.9 (0.5)	81.6 (0.1)	81.2 (0.1)	85.3 (0.3)
2003	85	7.1 (2.4)	76.6 (0.1)	74.7 (0.1)	101.0 (1.0)
2004	52	4.3 (1.2)	75.3 (0.2)	72.2 (0.1)	88.1 (0.5)
2005	40	3.5 (1.2)	72.5 (0.2)	70.5 (0.1)	84.0 (0.6)
2006	42	3.5 (1.3)	75.0 (0.1)	74.9 (0.1)	76.2 (0.6)
2007	59	4.9 (1.9)	70.0 (0.1)	69.1 (0.1)	76.8 (0.5)
2009	23	1.9 (1.2)	77.1 (0.2)	76.5 (0.1)	81.4 (0.8)
2010	29	2.4 (1.0)	76.3 (0.1)	75.9 (0.2)	79.0 (0.1)
2011	25	2.1 (0.9)	70.2 (0.3)	68.0 (0.2)	81.7 (1.3)
2012	22	1.8 (0.8)	80.2 (0.2)	77.6 (0.3)	84.2 (0.5)
2013	11	0.9 (0.4)	77.4 (0.3)	77.4 (0.1)	-
2014	2	0.17 (0.15)	81.1 (0.7)	81.1 (0.7)	-

Lake trout

Catch of surveyed lake trout has remained at some of its highest levels in recent years (Table 5). Lake trout (N = 9,955) were stocked in spring 2003 at an average total length of 292 mm (11.5 in) and again (N = 7,451) in the fall of 2005 at an average total length of 355 mm (14 in). These fish were differentially marked by fin clips to identify the two stockings. Non-clipped fish are assumed to be naturally reproduced (a.k.a. “wild”). Over the past three years only a few clipped fish have shown up during the annual survey with none from the 2005 stocking showing up since 2011. However, four fish from the 2005 stocking were captured durring a concurrent survey using new North American standard gill nets. Only one lake trout stocked in 2003 was surveyed in the 2014 survey. The abundance “wild” lake trout caught during the annual survey has increased to 98% of the sample.

Pactola Reservoir currently has a minimum length restriction of 610 mm (24 in) for lake trout. In 2014 the size range for surveyed fish was 285-700 mm (Figure 4). The presence of smaller fish indicates reproduction and recruitment continues to add to the population (Figure 4). Size structure of lake trout has varied greatly since 2003 with the highest value during last year’s survey (PSD=64). Several fish over the 24 inch (610 mm) minimum are caught by anglers in the winter and spring. The hook and line record was surpassed in Jan 2013 with a 30 lb fish. Last year, the surveyed fish stocked in 2003 were 460-610 mm (18-24 in), with the one this year at 575 mm (23 in). Fish captured in the North American standard nets from the 2005 stocking measured 450-600 mm. Mean condition (*Wr-S*) of lake trout over 12 inches was slightly lower than the last two years, but remains good. Condition of lake trout does seem to improve with increased size structure (PSD) (Figure 5).

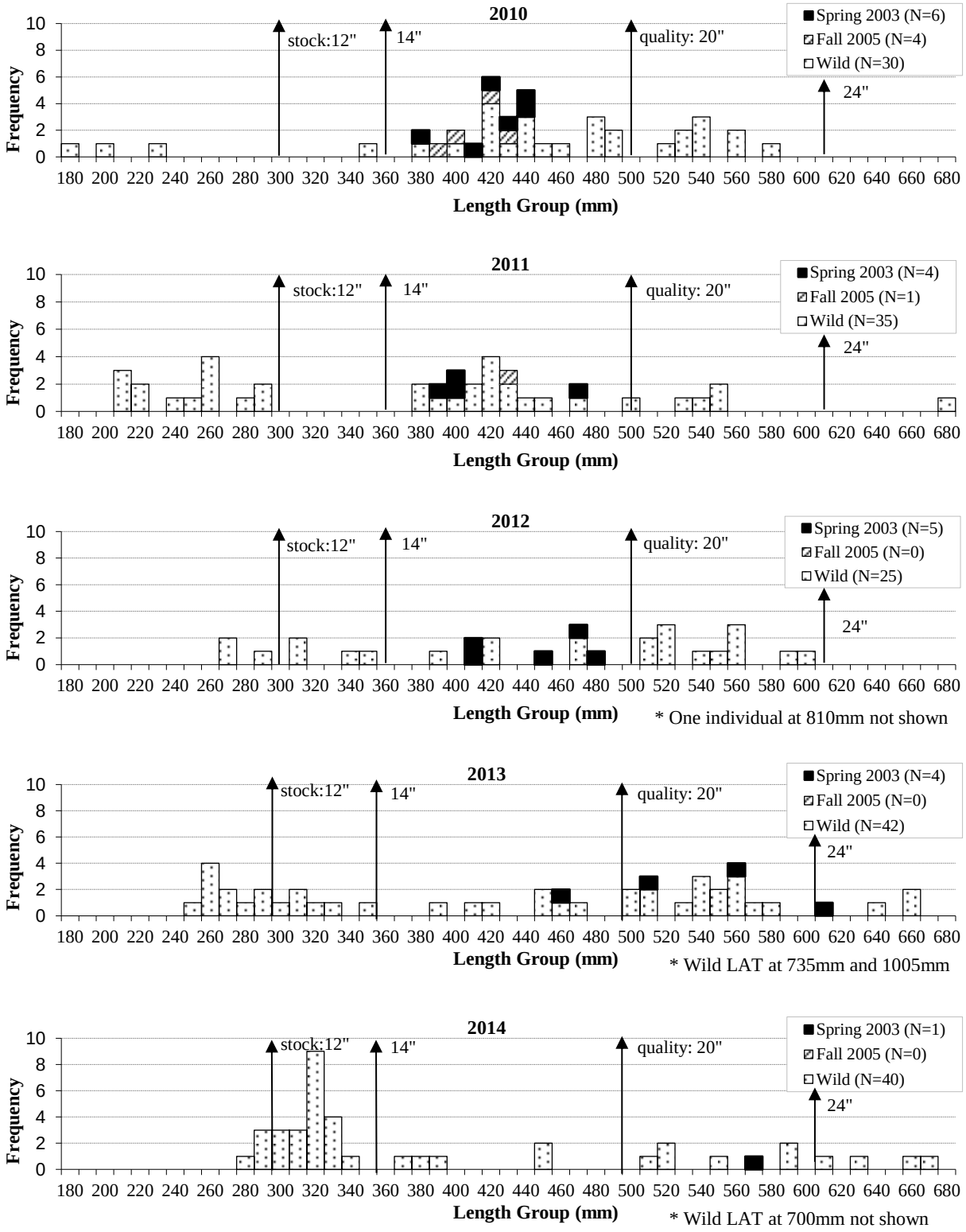

Figure 4. Length-frequency histograms for lake trout sampled with gill nets in Pactola Reservoir, 2010-2014.

Table 5. Parameters of lake trout surveyed from gill nets set in Pactola Reservoir including number of non-clipped (wild) fish surveyed and number over the 24 inch (610 mm) angler harvest minimum. Confidence intervals are presented in parenthesis.

Year	N	N Wild	N >610 mm	CPUE (80%)	CPUE-S (80%)	PSD (90%)	*Wr*-S (90%)	Mean Length (mm)
2003	16	3	3	1.3 (1.1)	0.8 (0.7)	33 (31)	102.1 (14.4)	303
2004	51	5	1	4.3 (1.3)	1.1 (0.4)	8 (13)	84.3 (7.5)	293
2005	16	4	3	1.3 (0.8)	0.8 (0.5)	30 (28)	86.3 (8.9)	389
2006	56	11	2	4.7 (1.6)	4.0 (1.3)	4 (5)	78.6 (1.8)	379
2007	65	21	0	5.4 (1.7)	5.1 (1.6)	0	82.7 (1.1)	370
2009	22	12	0	1.8 (0.9)	1.8 (0.9)	5 (7)	85.8 (2.1)	410
2010	40	30	0	3.3 (1.0)	3.1 (1.0)	24 (12)	87.1 (2.1)	437
2011	40	35	1	3.3 (1.5)	2.2 (0.8)	23 (14)	83.3 (2.8)	383
2012	30	25	1	2.5 (1.3)	2.3 (1.1)	48 (17)	92.7 (1.7)	466
2013	46	42	6	3.8 (1.0)	3.0 (0.6)	64 (14)	91.7 (2.5)	466
2014	41	40	5	3.5 (1.4)	3.2 (1.2)	32 (13)	87.7 (2.5)	410

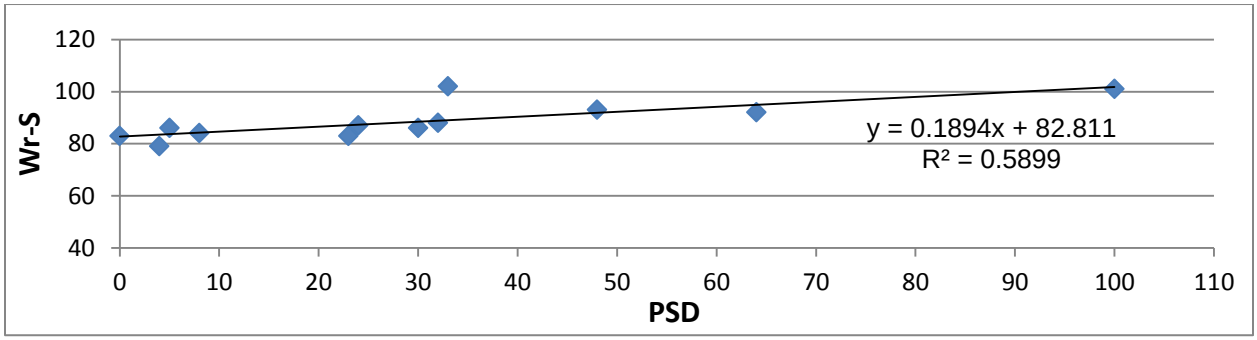

Figure 5. Lake trout size structure (PSD) and mean condition (*Wr*-S) for fish longer than 300 mm (12 in) in Pactola Reservoir, 2002-2014.

Bluegill

During the 2014 survey bluegills were the most abundant fish in gill nets and second most abundant in trap nets making up 33% and 32% of the catch, respectively (Tables 2 and 3). Bluegill condition has remained relatively steady with *Wr* values in the upper 80s and 90s (Table 6). Most bluegill caught in trap nets were between 100 and 200 mm (4-8 in) giving a PSD of 58, higher than the last two years (Table 6). No aging structures were collected, but length frequencies indicate different age classes with modes at 110 mm and 150 mm (Figure 6).

Table 6. Parameters of bluegill captured during trap net surveys of Pactola Reservoir.

Year	N	CPUE	PSD	PSD-P	*Wr*-S
2011	264	32.9 (15.4)	81 (4)	15 (3)	89.9 (2.7)
2012	242	30.3 (10.5)	48 (5)	5 (3)	88.1 (1.2)
2013	248	26.4 (12.2)	38 (5)	1 (1)	94.3 (1.6)
2014	166	20.8 (7.8)	58 (7)	10 (4)	88.0 (2.1)

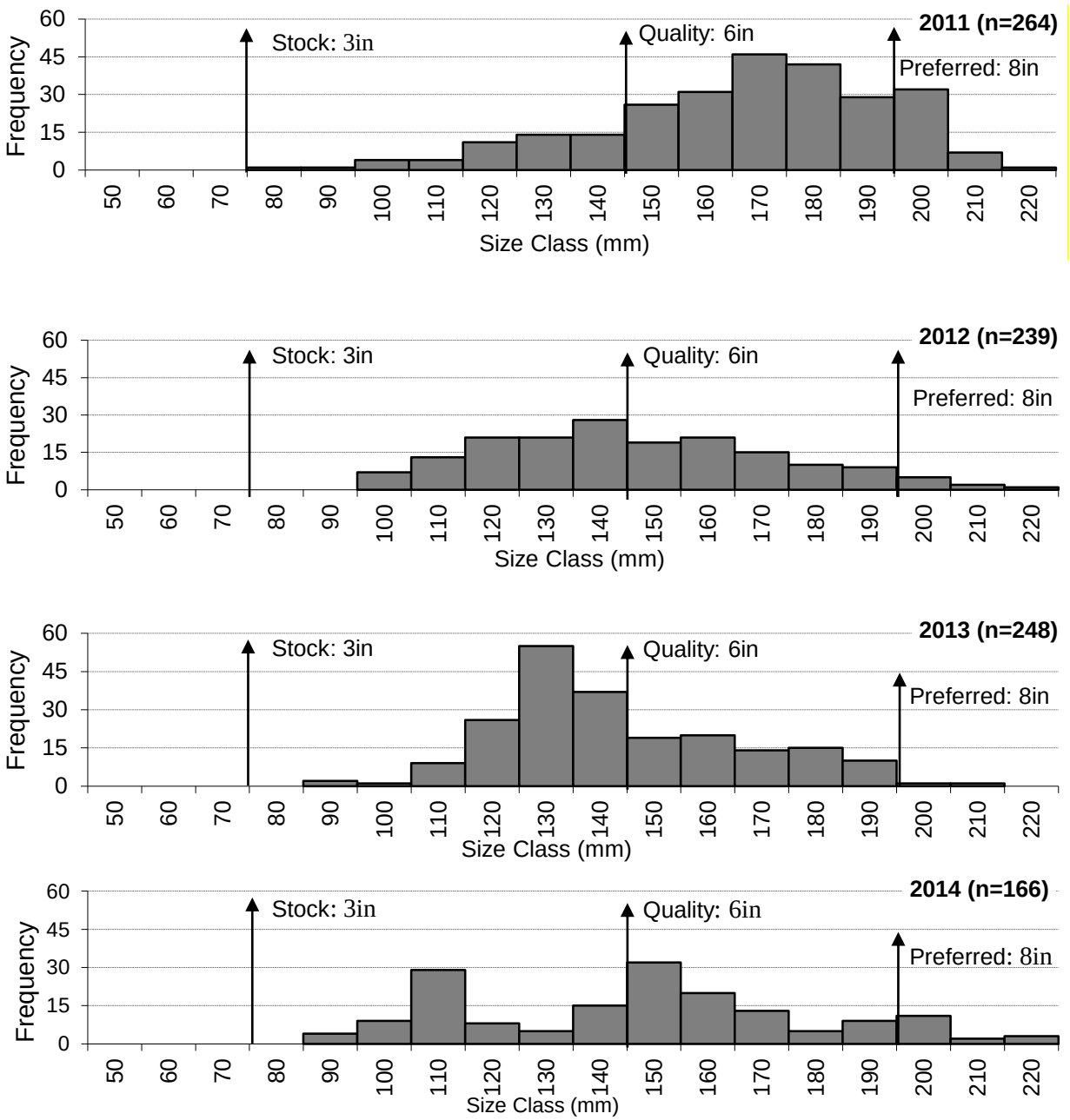

Figure 6. Length frequencies of bluegill captured during trap net surveys of Pactola Reservoir.

Northern pike

Although deep set gill nets are not the preferred method for sampling northern pike, gill net catch (CPUE) indicates an established population. Catch was back up slightly in 2014 with six surveyed (Table 7). All of the fish surveyed were over quality length (530 mm) with a range of 577-949 mm.

Table 7. Abundance, condition, and stock indices for northern pike captured during gill net surveys of Pactola Reservoir in 2003-2014.

Year	N	CPUE	PSD 90% CI	PSD-P 90% CI	PSD-M 90% CI	*Wr*-S 90% CI	Mean length (mm)
2003	1	0.19	100	0	0	97	576
2004	0	0	-	-	-	-	-
2005	0	0	-	-	-	-	-
2006	4	0.3	100	0	0	100 (3)	575
2007	4	0.3	75 (59)	25 (59)	0	99 (9)	621
2009	5	0.4	60 (52)	40 (52)	0	86 (8)	583
2010	10	0.8	50 (36)	13 (23)	0	87 (4)	497
2011	14	0.9	77 (22)	31 (24)	8 (13)	95 (5)	595
2012	11	0.5	82 (22)	45 (28)	27 (25)	100 (6)	679
2013	3	0.3	33 (67)	0	0	93 (10)	458
2014	6	0.5	100	33 (43)	33 (43)	116.1 (13)	734

Yellow perch

Yellow perch survey abundance was higher again in 2014 after two years of low catch rates. They were the second most abundant species in gill nets. Size structure was low with a mean total length of 174 mm (6.9 in) and PSD of 13. Condition (*Wr*) was high at 94.4

Secondary species

Black crappie are sometimes captured during the Pactola Reservoir survey with two in 2002, 21 in 2011, and 17 in 2014. This is most likely due to net placement and timing of the survey, since all fish were captured in two nets.

Rock bass were surveyed at their highest abundance in 2014, making up 54% of the trap net catch. Largemouth bass, rainbow smelt, white sucker, and European rudd were captured in low abundance (Tables 2 and 3).

RECOMMENDATIONS

1. Conduct a lake survey every one to two years to update information on fish populations and evaluate management strategies.

2. Collect otoliths from dead or dying lake trout captured in gill nets to build information on population dynamics including age structure and growth rates.

3. Develop management strategies addressing findings from graduate study results.

REFERENCES

Bureau of Reclamation, U.S. Department of the Interior. Current Reservoir Data for Pactola Reservoir, SD. 10 Nov 2011. <http://www.usbr.gov/gp-bin/arcweb_ptr.pl>

Scheibel, N. C. 2015. Age, Growth, and Trophic Interactions of Lake Trout and Northern Pike in Pactola Reservoir: Implications for Lake Trout Management. South Dakota State University. Brookings, South Dakota.

APPENDIX

Appendix 1. Stocking record for Pactola Reservoir, South Dakota, 2005-2014.

Year	Species (Strain)	Size	Stockings	Number of fish
2005	Lake trout	Catchable	1	7,451
	Rainbow trout (Shasta)	Catchable	3	14,997
2006	Rainbow trout (Erwin)	Catchable	8	22,366
	Rainbow trout (Shasta)	Catchable	1	4,000
2007	Brown Trout (Soda Lake)	Catchable	1	4,700
	Rainbow trout (Erwin)	Catchable	1	3,000
	Rainbow trout (Shasta)	Catchable	1	2,800
2008	Rainbow trout (McConaughy)	Catchable	1	2,125
	Rainbow trout (Shasta)	Catchable	2	4,963
	Rainbow trout (Utah)	Catchable	1	7,975
2009	Rainbow trout (Erwin)	Catchable	1	3,300
	Rainbow trout (McConaughy)	Catchable	1	2,400
	Rainbow trout (McConaughy)	Fingerling	2	7,420
	Rainbow trout (Shasta)	Catchable	9	22,699
	Rainbow trout (Shasta)	Fingerling	2	4,603
	Rainbow trout (Shasta)	Small Fingerling	1	12,420
2010	Rainbow trout (Erwin X Arlee)	Catchable	2	9,619
	Rainbow trout (Shasta)	Catchable	5	19,425
2011	Rainbow trout (Erwin X Arlee)	Catchable	2	8,905
	Rainbow trout (Shasta)	Catchable	4	19,837
2012	Rainbow trout (Erwin X Arlee)	Catchable	2	9,450
	Rainbow trout (Shasta)	Catchable	5	19,484
2013	Rainbow trout (Shasta)	Catchable 11”	5	17,400
	Rainbow trout (Shasta)	Catchable 15”	1	125
	Rainbow trout (McConaughy)	Catchable 11”	4	13,324
2014	Rainbow trout (Erwin X Arlee)	Catchable 11”	1	880
	Rainbow trout (Erwin X Arlee)	Catchable 15”	1	354
	Rainbow trout (McConaughy)	Catchable 11”	1	699
	Rainbow trout (Shasta)	Catchable	8	28,319